Haier SERVICE MANUAL

Order No.Ref0912S026V0

Refrigerator

MODEL: HRF-660SAA

⚠ WARNING

This service information is designed for experienced repair technicians only and is not designed for use by the general public. It dose not contain warnings and cautions to advice non-technical individuals of potential dangers in attempting to service a product. Product powered by electricity should by serviced or repaired only by experienced professional technicians. Any attempt to service or repair the product or products dealt with in this service information by anyone else could result in serious injury or death.

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Haier Group

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Chapter 1 General Information

1-1. General Guidelines

When servicing, observe the original lead dress. If a short circuit is found, replace all parts which have been overheated or damaged by the short circuit. After servicing, see to it that all the protective devices such as insulation barriers, insulation papers shields are properly installed. After servicing, make the following leakage current checks to prevent the customer from being exposed to shock hazards.

1) Leakage Current Cold Check

2) Leakage Current Hot Check

3) Prevention of Electro Static Discharge (ESD) to Electrostatic Sensitive

1-2. Insurance notice

1. Check if there is any leak of current.
2. Cut out the power supply before the repair to avoid an electrical shock hazard.
3. In the case of a live-line test, insulating gloves should be worn to avoid potential electrical shock.
4. Confirm the rated current, voltage and capacity before testing with any kinds of instruments.
5. Watch if the upper door is open when you check something at a lower position.
6. Take out every part in the cabinet before moving the machine, especially things like panels (e.g. glass shelf).
7. Please wear intact cotton gloves when repair any parts of the evaporator, so that scratches by the sharp fins can be avoided.
8. If there is a breakdown with the refrigeration system, please surrender the machine to the service center, else the leaked refrigerant may pollute the atmosphere.
9. The refrigerator use AC of 220V with a frequency of 50Hz.
10. A big fluctuation of voltage (exceed the range 187～242V) may cause a start failure of the refrigerator, a burn-out of the control panel and compressor, or an abnormal sound from the compressor in operation. In this condition an automatic voltage regulator over 200W should be added.
11. Take care not to damage the supply line. Don’t yank at the line; pull the plug out gently from the receptacle. Don’t press the line under the cabinet or step on it. Take care not to roll on or damage the

supply line when moves the machine from the wall.

12. In the case of leakage of inflammable gases like carbon monoxide, open the door and windows. Don't pull out or insert the plugs of the appliance.
13. Don't touch the refrigeration surface of the freezing compartment when the refrigerator is in operation, especially when your hand is wet, else you may be glued to the surface.
14. Pull out the plug of power supply during clearance or power outage. Wait at least five minutes to resume the power supply in order to prevent damage to the compressor caused by continuous restart.

Photo used in this manual

The illustration and photos used in this Manual may not base on the final design of products, which may differ from your products in some way.

1-3. How to read this Service Manual

1-3-1. Using Icons

The meaning of each icon is described in the table below:

Note:

A "note" provides information that is not indispensable.

Caution:

A "caution" is used when there is danger, through incorrect manipulation, may damage equipment, loose data, get an unexpected result or has to restart (part of) a procedure.

Warning:

A "warning" is used when there is danger of personal injury.

Reference:

A "reference" guides to other places in this binder or in this manual, where we will find additional information on a specific topic.

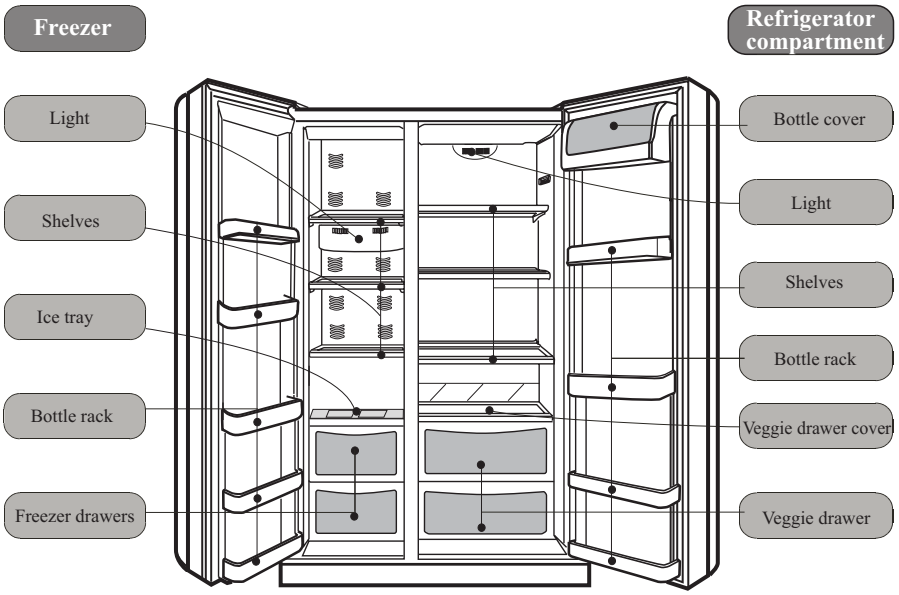
Chapter 2 Product Feature

2-1. SPECIFICATIONS

	REFRIGERATOR		
1	**Model**	**units**	**HRF-660SAA**
	Commercial brand		**Haier**
	Product description		**SBS**
	Type of Appliance (FS= freestanding BI= built-in)		FS
	Climate class (N= + 18-32 °C T=+ 18-43 °C)		SN.N.ST
2	**Key features**		
	Gross capacity	l	600
	Total net capacity	l	530
	Defrosting (**H**=manual **A**=automatic) ***Fridge/Freezer***		A
	Defrost water outlet		Yes
	Air circulating ventilator		Yes
	Kind of coolant *(R134a/R600a)*		R600a
	Foaming components		CP-IP
3	**Technical data**		
	Voltage / frequency	V/Hz	220-240 V~/ 50
	Input power / mains fuse minimum	W /A	200/2.2
	Length of cable / *incl. plug*	cm	200
	Temperature range (from>to) ***Fridge / Freeze***	°C	10~-26
4	**Aesthetics**		
	Colours (see **L**)**:**		Silver
	Top cover		Silver
	Cabinet		Silver PCM
	Door		Silver VCM
	Fascia panel / Handle		Silver
	Door:		
	F= Flat / R= Rounded / S= Streamline		F
	Hinged *(r =right l =left) / reversible)*		*r & l*
	Lock （yes/not）		No
	Shelves:		

	Number		8
	Type (gr=grill/g=glass/p=plastic)		glass:8
	Colour of shelves		white
	Adjustable		YES
	Drawers:		
	Number	n°.	4
	Crisper:		
	Salad crisper(s) *transparent / white*		transparent
5	**Equipment & Accessories**		
	Control Panel:		
	Control panel *interior / exterior*		Exterior
	Control lamps *green / yellow / red*		blue
	Over temperature ALARM *LED / acoustic*		acoustic
	Adjustable thermostat		Yes
	Fast freeze switch		Yes
	Interior light	W	2
	Adjustable feet *front / rear*	n°	front
	Castors *front / rear*		front / rear
6	**Product dimensions**		
	Unit dimensions ***H / W / D***	cm	176.8*66.5*77
	Depth with open door	cm	110
	Net weight	kg	110
7	**Packing dimensions & load ability**		
	Packing dimensions ***H / W / D***	cm	189.4*96*77
	Gross weight	kg	122
8	**Recycling symbols**		
	Carton *weight in g*	kg	8
9	**Service**		
	Users instruction *(languages)*		8 languages

2-2. External views

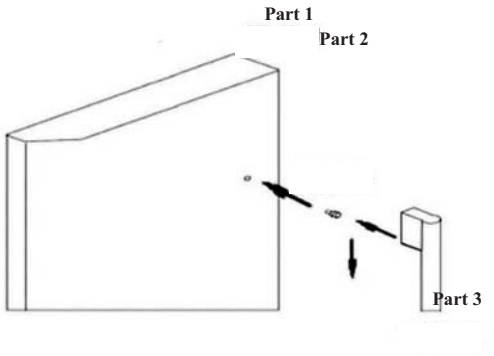


Note

Chapter 3 Installation, adjustments and maintenance

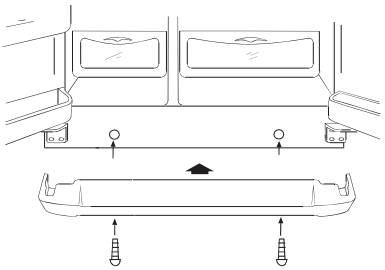
3-1. Install Handle

First, screw part2 into the threaded hole in the door (part1); there are two screws per door. Next, press part3 with its larger opening onto part2. Finally, pull part3 down in order to attach it firmly to the door.



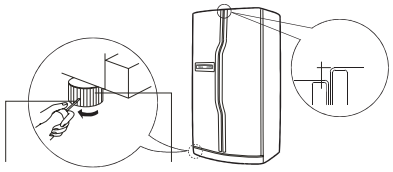
3-2. Below decorative moulding

Open the refrigerator and freezer doors, remove the moulding from the refrigerator compartment, and then affix it as shown in the illustration.



3-3. Adjustable foot

If the freezer compartment door is lower than that of the refrigerator compartment, insert the wrench in the groove of the left screw and turn it in the direction of the arrow until both doors are the same height.



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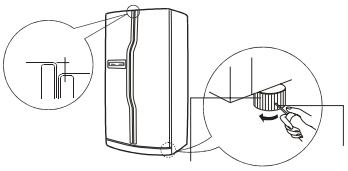


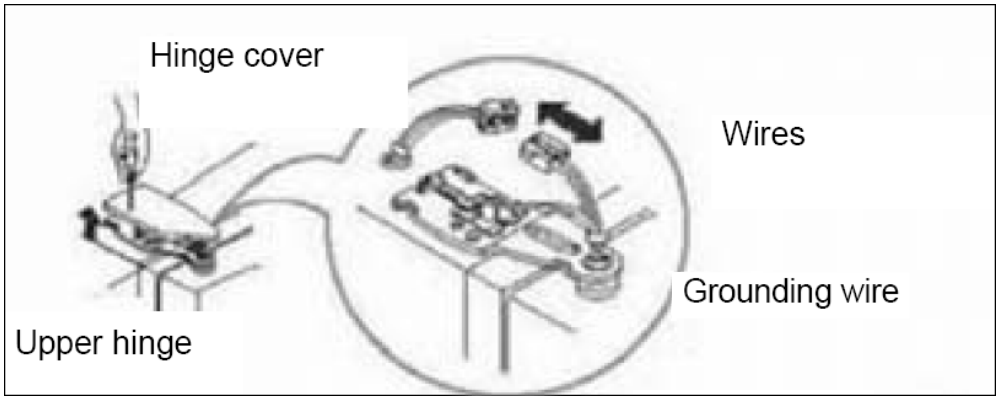
Chapter 4 Disassembly

4-1. Doors

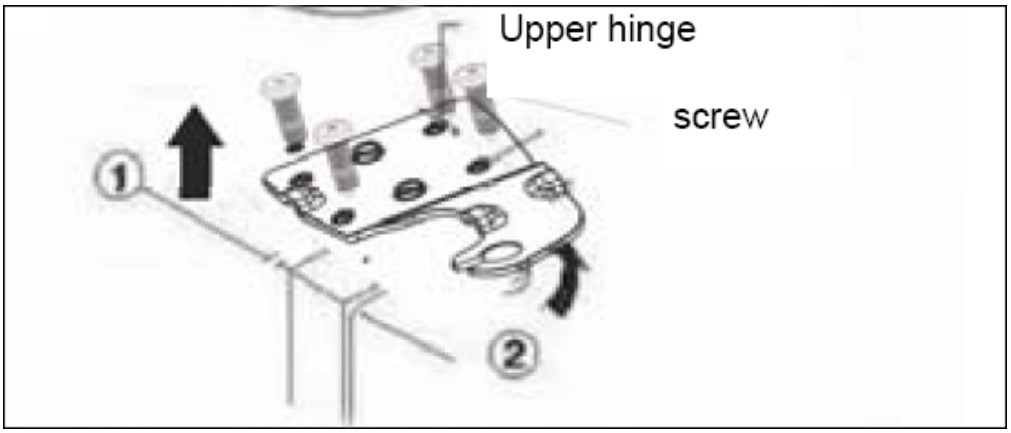
1. Open the refrigerator and freezer doors, remove the moulding from the refrigerator.

2. Remove the freezer compartment door.

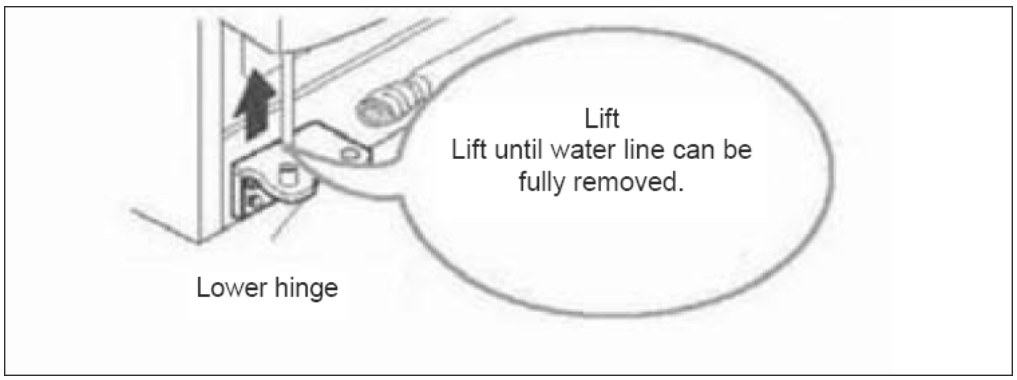
1) Unscrew the hinge covers. Disconnect all wires except for the grounding wire.



2) Remove the screws from the upper hinge following the direction as indicated by Arrow(1). Then remove the upper hinge following the direction as indicated by Arrow (2).

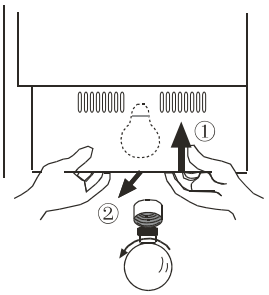


3)Lift the freezer compartment door to remove it.



4-2.Bulb

Replacing the bulb at the top of refrigerator compartment Bulb specifications: 220-240V/25W Socket: E27 (Do not use a replacement bulb of more than 25W.) Replacing the bulb Install the bulb. Unplug the power cord. Remove the screws under the cover. Lift the cover indirection (1), and then pull it out indirection (2). Twist the bulb anticlockwise, and then remove it. Install a new bulb of equal specifications. Re-install the cover.

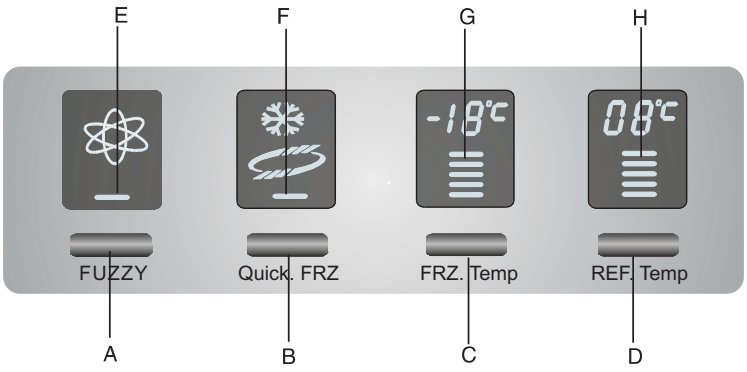


Chapter 5 Control principle and display system

5-1. Control and display panel

1. Keys and Display panel

The screen becomes dark automatically 30 minutes after key operation. Press any key or open any door to restore the display.



A. Intelligent mode key
B. Super frost key
C. Freezer temperature adjustment key
D. Refrigerator temperature adjustment key
E. Intelligent mode indicator
F. Super frost indicator
G. Freezer temperature display
H. Refrigerator temperature display

5-2. Function adjustment and working principle

1. Initial State

1.1 For initial power-on, the temperature setting for refrigerator compartment and freezer compartment is preset at fuzzy mode; fast freeze is not selected.

1.2 For initial power-on, if the temperature of refrigerator compartment falls within the range of temperature corresponding to starts and stops of compressor, the compressor won't start until the temperature rises to the starting point; if the temperature of freezer compartment is higher than the shutdown point, the compressor is started.

1.3 After the first power-on, the previous state will be displayed when the unit is powered on again.

2. Temperature setting of freezer compartment / refrigerator compartment

Temperature Parameters

Areas	NOTCH	1 (weak)	2	3	4	5 (strong)
	Preset temperature of freezing (°C)	-15	-17	-18	-20	-22
	Actual control temperature (°C)	-17	-19	-20	-22	-24
	Preset temperature of cold storage (°C)	7	6	5	4	3
	Actual control temperature (°C)	6	5	4	2	0

2.1 How to select a temperature setting

(1)The appliance is preset at fuzzy mode, which can be inactivated by a press of Fuzzy Mode button.

(2)The temperature setting of freezer compartment / refrigerator compartment are set by the freezing and refrigeration keys on the display panel respectively..(Fuzzy mode must be inactivated.)

(3) The freezing/ refrigeration keys correspond with display icons.

(4) Press and hold down the refrigeration key for 3 seconds, the refrigeration operation in refrigerator compartment is deactivated and its temperature setting display is off; press and hold down it again for 3 seconds, the refrigeration function is resumed and its temperature setting display is on. When the refrigeration function is suspended, the refrigeration load is canceled in correspondence to 2.

2.2 Displays

(1) Press freeze or cold storage key once to obtain the next higher setting until the highest setting is reached. Press again to return to the lowest setting.

Type	Display
Freeze	1→2→3→4→5→1 / The sequence of temperature displays is: -15°C→-17°C→-18°C→-20°C→-22°C→-15°C
Cold storage	1→2→3→4→5→1 /The sequence of temperature displays is: 7°C→6°C→5°C→4°C→3°C→7°C

(2) Room Temperature Sensor (RT SNR) The startup and shutdown parameters can be adjusted with the temperature change of RT SNR.

	RT≤20°C	20°C<RT≤35°C	35°C<RT
Freeze	-2°C	-1°C	-2°C
Cold storage	+1°C	-1	-2°C

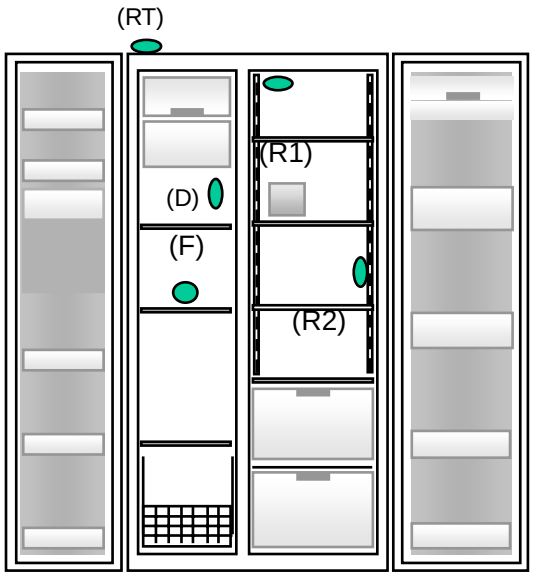
2.3 Controls

2.3.1 Temperature Control

(1) Temperature control of freezer compartment /refrigerator compartment

Item	Compressor ON or air damper ON	Compressor OFF or air damper OFF	Sensor
Freezer compartment	NOTCH+1.5°C	NOTCH-1.5°C	F SNR
Refrigerator compartment	NOTCH+1.5°C	NOTCH-1.5°C	R1 SNR

(2) Name and position of each sensor



Name	Code	Position
Freezer sensor	F SNR	middle of freezer compartment
1efrigerator sensor1	R1 SNR	Control box (refrigerator air damper assembly)
Refrigerator sensor2	R2 SNR	Right wall of refrigerator compartment
RT SNR	RT SNR	Below freezer hinge box
Defrosting sensor	D SNR	Above freezer evaporator

2.3.2 Compressor Control

(1) ON/OFF conditions of compressor

ON	OFF
1. Powered on for the first time or after defrosting (F SNR is higher than shutdown point) 2. F SNR reaches startup point 3. In fast freeze state 4. Refrigerator load in correspondence with condition 2 5. TEST MODE1 (PULL DOWN) 。	1. After defrosting, F SNR is not higher than shutdown point; 2. F SNR reaches shutdown point 3. In defrosting state; 4. Refrigerator load not in correspondence with condition 2 5. TEST MODE2 (forced defrosting)

(2) The compressor will be shut down during operating if one of the following appears:

a) During defrosting or within 7 minutes after the finishing of defrosting.

b) Within 7 minutes after compressor shutdown.

c) Within 7 minutes after the previous state is restored manually from forced state.

2.3.3 Freezer fan control DC fan is adopted for the control of freezer fan.

DC fan is adopted for the control of freezer fan.

(1) ON/OFF conditions of freezer fan

2.3.4 Control of cooling fan

(1)A DC fan is adopted.

(2)The fan is operating synchronously with compressor

(3)Under DC control, the fan works at a constant speed of 1100RPM (11V).

2.3.5 Lighting control of refrigerator

(1)The light is on if the door is opened; the light extinguishes if the door is closed.

(2)The light extinguishes automatically if the door is opened for more than 7 minutes.

2.3.6 Air damper control of refrigerator

(1) R1 SNR controls the startup and shutdown of air damper in refrigerator compartment.

(2) The air damper is closed (in order to prevent the compartment from freezing) within 15 minutes from the beginning to the finishing of defrosting.

(3) The air damper is closed and opened once upon initial power-on. It is controlled opened and closed as per condition (1).

(4) Force the air damper to be opened and closed once if it cannot be opened within 1 hour. After that, decide whether open or close it according to R1 SNR.

(5)Heating elements of air damper and ice outlet are heated synchronously. continuous heating

(6) If the temperature still rises (or drops) within 10 minutes after opening or closing of air damper, open or close it again.

(7) Heating element of dispenser (as well as heating element of inlet pipe) is off for 10 minutes and is on for 30 minutes as a cycle.

2.4 Functional controls

2.4.1 Fast freeze

(1)Press fast freeze key to activate this function.

(2)Corresponding icon is displayed in fast freeze state; the icon extinguishes when fast freeze is ended.

(3) During fast freeze, the selected settings of freezer or refrigerator compartment remain unchanged.

(4)During fast freeze, the setting in refrigerator compartment is adjustable, while the setting in freezer compartment is not.

(5)The compress operates 3 hours continuously and then stops in fast freeze.

(6)Defrosting has a higher priority than fast freeze. The defrosting time is included in fast freeze time. The fast freeze display is on all the time during defrosting. End of fast freeze and end of automatic defrosting are controlled by respective conditions. When either of the two states is ended, the other state will not be affected.

2.4.2; Refrigerator load in correspondence with condition 2

(1) Ambient temperature is above 18°C.

(2) If the temperature of R1 is higher than 12°C or the temperature of R1 is higher than 13°C, the compressor starts up and the air damper of refrigerator compartment is opened. The freezer fan operates at a speed of 1500RPM.

(3) If R1 reaches shutdown point or the temperature of R2 drops below 2°C, that the refrigerator load corresponding with condition 2 is ended.

(4) After the end of refrigerator load corresponding with condition 2, the rotation speed of fan is 1300RPM within 10 hours whatever the actual temperature is in freezer or refrigerator compartment.

2.5 Defrosting

2.5.1 Normal defrosting (automatic defrosting)

(1)The compressor operates 7 hours accumulatively before defrosting is activated; when defrosting SNR reaches above 7°C, defrosting is ended.

(2)The compressor stops and air damper is closed during defrosting.

(3)The compressor operates 4 hours accumulatively upon initial power-on before the first defrosting is activated.

(4) Automatic defrosting begins after the compressor operates accumulatively 7 hours except for (3).
(5)Defrosting will not begins if there is something wrong with defrosting SNR (short circuit or broken circuit).

(6) If the defrosting SNR cannot reach 7°C 120 minutes after defrosting, the defrosting heating element is disconnected and an alarm is given, which glitters in the Position 4. If the SNR can reach 7°C within 120 minutes, the alarm is canceled.

(7) The compressor and freezer fan are operated before defrosting until the freeze SNR reaches the shutdown point -2°C to begin defrosting, which minimize the temperature rise in freezer and refrigerator compartments during defrosting (pre-refrigeration before defrosting).

(8) After defrosting, if the compressor operates 4 hours continuously, the defrosting will begin again.

(9)Fast freeze display is powered on in fast freeze state during defrosting while automatic defrosting goes on. At the end of automatic defrosting, fast freeze will begin again. The remaining time of defrosting is included in fast freeze time.

(10) After defrosting, the compressor and fan stops 7 minutes, if F SNR is higher than shutdown point, the compress starts up 5 minutes, after that, the fan operates. The air damper will be opened or closed according to temperature after the fan has operated for 3 minutes.

2.5.2 Forced defrosting

(1)Press TEST key twice on main control panel to start forced defrosting.

(2)With the door closed, the heating element is forced open, the defrosting will stops after 4 minutes or defrosting SNR reaches 7°C. The temperature settings of freezer and refrigerator compartment return to the state before forced defrosting. If F SNR is higher than the shutdown point 7 minutes after the compressor and fan are off, the compressor will operate for 5 minutes and then the freezer fan will operate for 3 minutes. The air damper will be opened or closed accordingly.

2.6 Door-open alarm

(1)If the door of freezer or refrigerator compartment stays open for 60 seconds, an alarm will be given.

(2)The buzzer gives alarm 3 times every 0.5 second. If any switch is powered on, the buzzer gives 3 alarms at an interval of 0.5 seconds every 30 seconds until the two switches are disconnected. The buzzer gives a sound of “ding dong” when alarming.

(3) Alarm stops after the door is closed

2.7 Functional tests

MODE	Action	Description	Remark
TEST1	Enter by pressing TEST key one time (cooling capacity MODE)	1) COMP ON 2) F FAN (high speed)ON 3) C FAN(low speed)ON 4) DEF/BAR HTR OFF 5) air dampers are opened.	With TEST1, TEST 1 mode is maintained until manually ended
TEST2	Enter by pressing TEST key once more in TEST 1 MODE (forced defrosting MODE)	1) COMP OFF 2) F/C FAN OFF 3) D HTR ON 4) air dampers are closed.	Press exit key to force defrosting to operate
Normal reset	reset by Pressing TEST key for the 3rd time	Reset of refrigerator functions (the compressor will start 7 minutes later)	

2.7.1 Additional information of TEST functions

(1) Continuous operation in TEST 1 MODE.

(2)TEST2 should be activated 0.1 second later from TEST1 to TEST2.

(3)The keys on display panel are inactivated in TEST1 or TEST2 MODE.

(4)It is useless to press TEST key before powered on.

(5)TEST cannot be used in fault mode. If there is fault detected in TEST, it can be displayed after the reset of control panel.

2.8 Fault diagnostics

2.8.1 Description and display

No.	Item	Indication		Description
		F SET	R SET	
1	Normal	Normal setting indication of preset temperature		none
2	F SNR is defective	F4	normal	F SNR short circuit or broken circuit
3	RT SNR is defective	normal	F3	RT SNR short circuit or broken circuit
4	R1 SNR is defective	normal	F1	R1 SNR short circuit or broken circuit
5	R2 SNR is defective	normal	F2	R2 SNR short circuit or broken circuit
6	D SNR is defective	normal	F6	D SNR short circuit or broken circuit
7	Freezer fan motor failure	normal	E1	more than 30 seconds without signal
8	Condenser fan motor failure	normal	E2	more than 30 seconds without signal
9	Defective commuciation	normal	E0	No reflect when setting ,between display PCB and Power PCB no signal transmitted over 2 min
10	Defrosting fault	normal	Ed	not reach -12℃ within 2 hours

2.8.2 Addition information in fault mode

(1) TEST key is activated and others are canceled in fault mode.

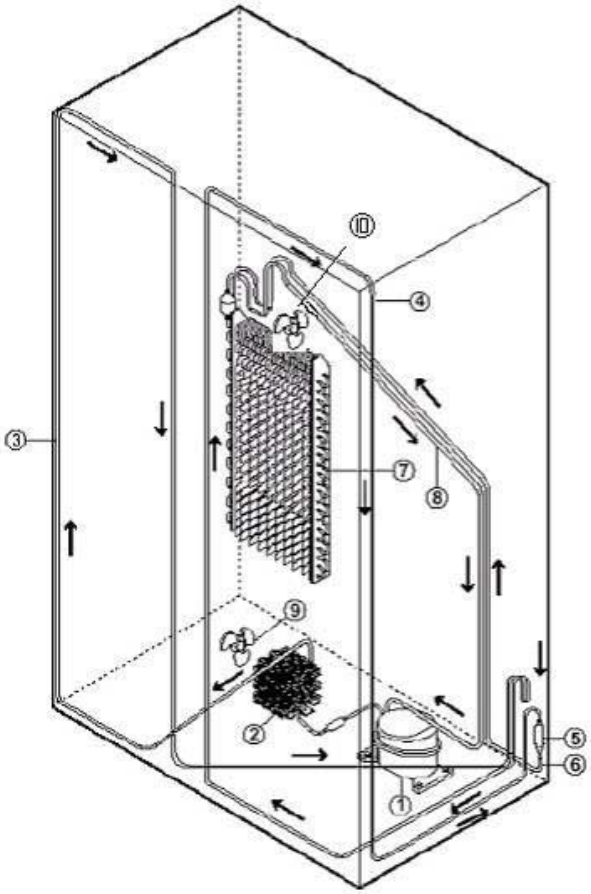
(2) The fault types of refrigerator or freezer are indicated in corresponding display area in fault mode.

(3)Indication returns to normal after being checked to be normal in fault mode.

Chapter 6 System flow principle

6-1. Refrigeration flow scenograph

The product adopts an air-cooled refrigeration system to ensure accurate refrigeration in freezer compartment and refrigeration compartment.

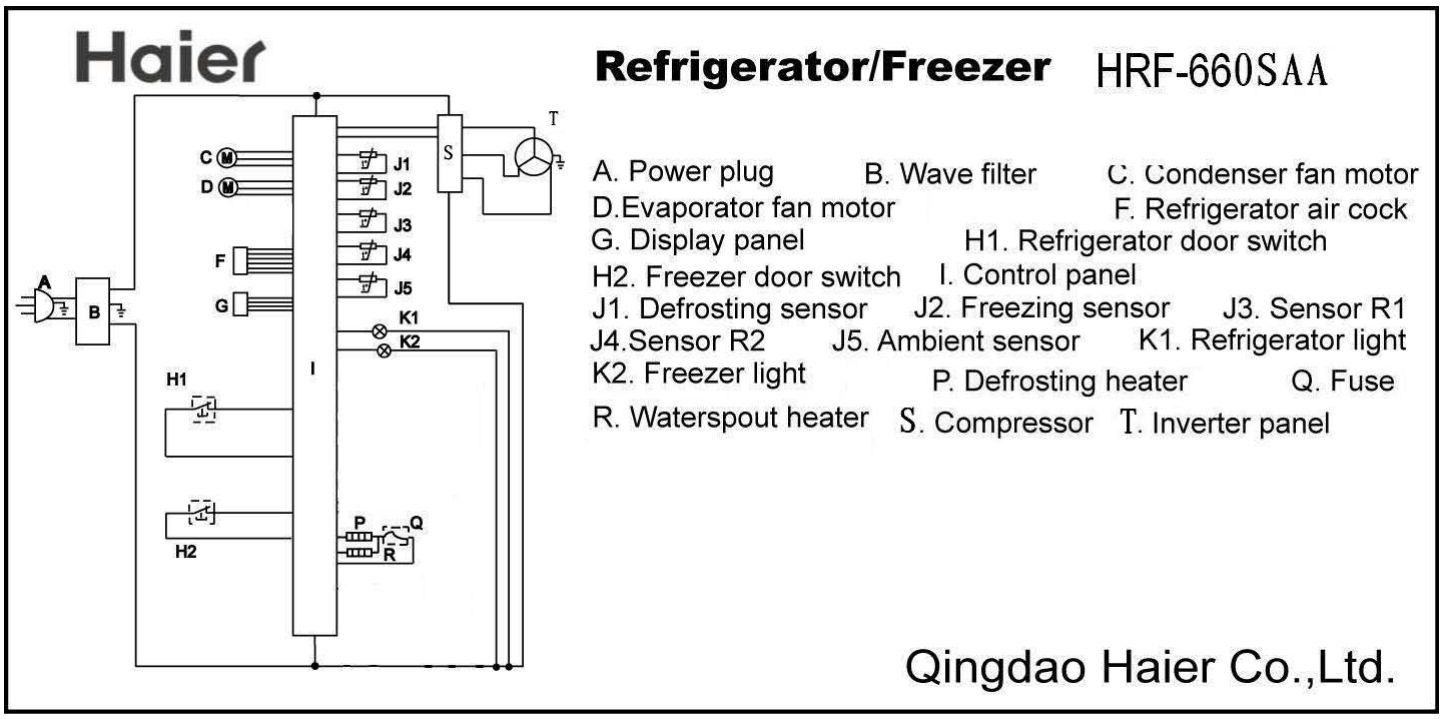


System flow scenograph

① Compressor
② Condenser
③ Hot connector pipe for freezer
④ Hot connector pipe for fridge
⑤ Drier filter
⑥ Capillary tube
⑦ Evaporator
⑧ Suction pipe
⑨ Compressor DC fan motor
⑩ Freezer DC fan motor

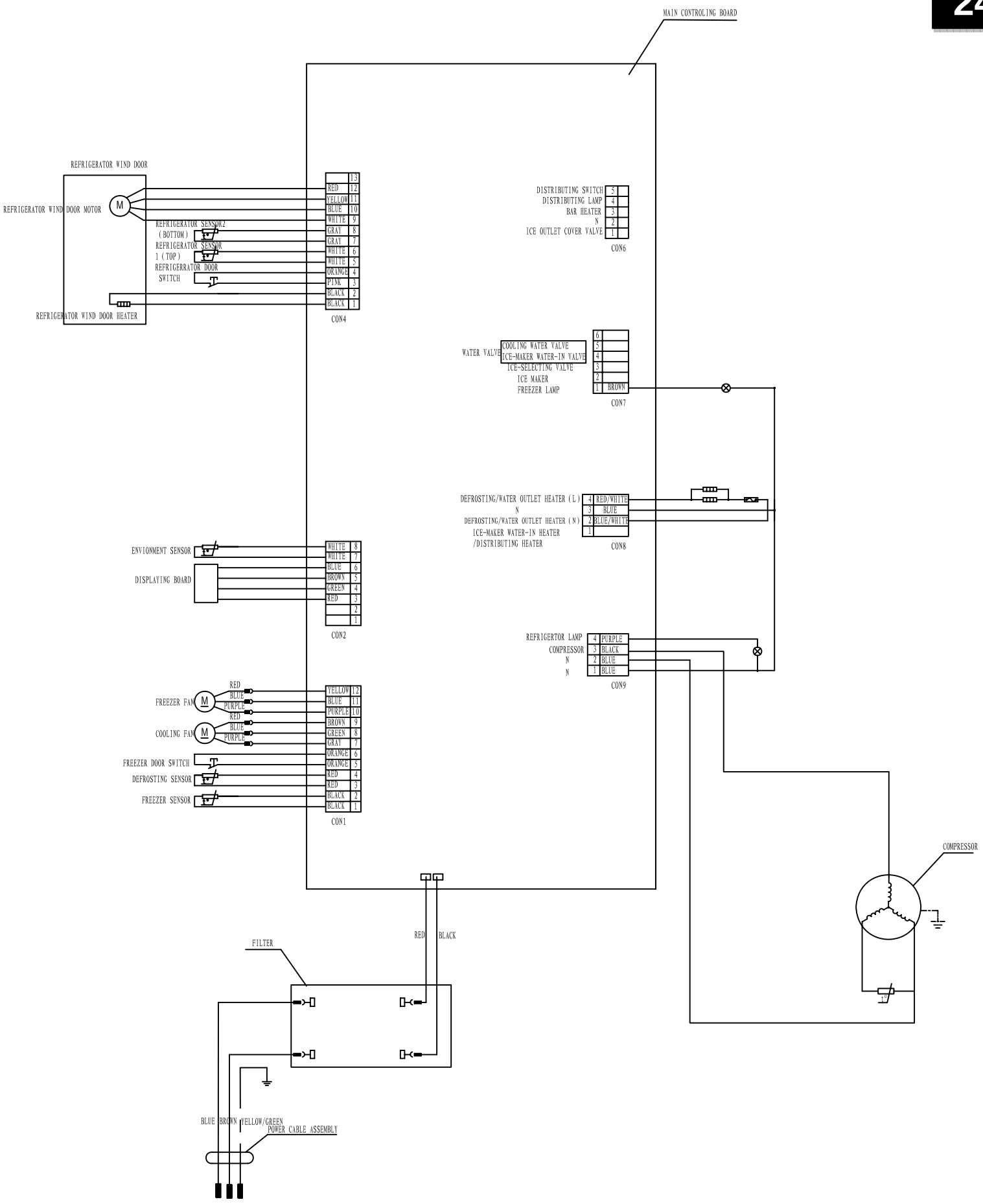
Chapter 7 Circuit diagram

7-1. Brief principle diagram



HRF-660S* is the forced air cooling refrigerator with two doors (side by side). The control panel directly controls the start and stop of compressor.

7-2. Main control PCB diagram



Chapter 8 Trouble shooting

8-1. Normal phenomena

In a domestic refrigerator, there is not only a complicated electric control system, but also a refrigerating system that is difficult to discern whether it is in a good working condition. Both the systems are related and affect each other. If a certain part of a refrigerator works abnormally .Its refrigerating efficiency will decrease, operation properties will become unstable, or even it cannot be used normally for those serious cases.

Refrigerators are generally of larger volume, once troubles appear, to send them to a service department is really a tough thing, if such is the case, the user will always be in suspense, sometimes, normal phenomena will be erroneously regarded as troubles .Therefore ,before we deal with the topics of frequently occurring troubles of refrigerators and their remedies ,we should firstly give a brief account of some normal phenomena which are not troubles .In case any one of such phenomena occurs ,there is no need to worry about it ,and the user can use it at total ease .

1).When the compressor of a refrigerator has just stopped running, a rumbling sound can be heard from inside its evaporator .This is a sound caused by the flowing of refrigerant in the evaporator tubing .Because the pressure difference is still greater after the compressor has just stopped running, the refrigerant will flow for a certain time, therefore, this sound is a normal phenomenon.

2).A click sound can often be heard from the refrigerator .This is a normal sound produced by the pull-in or release of the armature of a current deadweight start relay when starting the compressor. The compressor motor will produce a slight and uniform sound while it is running .This sound is not easy to be heard in the daytime, but of course it can be heard distinctly at night.

3).The compressor consists of an electric motor and a compressing apparatus .During its normal operation, the motor’s stator core and windings will rise to a temperature in the range of 100 ~110, and the temperature of the piston and cylinder of the compressing mechanism can also reach as above 100 due to the heat produced when compressing refrigerant .Most of the heat radiates to the air through the compressor casing, therefore, its casing is generally at a temperature between 85 ~90, it is very hot ,particularly in summer when the ambient temperature is higher .All these are normal phenomena .

4).For the direct cooling refrigerator ,a kind of irregular crack sound can be often heard when the compressor is running for a certain period of time or has just stopped its running .This sound is caused by the stress relief due to expansion and contraction when temperature changes ,and will not affect the normal application of refrigerator .

8-2 Common Troubles in Refrigerators and Their Remedies

Causes for troubles occurring in refrigerators are closely related to the quality of components and workmanship in assembling by manufacturers as whether refrigerators are properly used and maintained .The parameters generally used to express the working conditions of a refrigerator include the temperature inside the refrigerator ,operation rate ,electric power consumption ,noise level ,and other functional indexes .If any one of these parameters is beyond its permissible range ,this indicates that there is a fault or trouble in the refrigerator .

During the whole service life of a refrigerator ,the probability of troubles occurring within a union time is called its failure rate .Making a comparison between the control circuit system of a refrigerator and its refrigerating system ,we can find that the failure rate of the former is higher ,and that of the thermostat is the highest . In troubleshooting ,the first thing you must do is to determine where the trouble comes from --- the control system or the refrigerating system .There is general no trouble indicating instrument mounted on the domestic refrigerator ,locations and natures of troubles should be determined according to their respective features ,therefore ,experience in servicing is very important to troubleshooting .Service technicians with rich experience can correctly locate them and take reasonable remedy measures based on their comprehensive analysis of trouble characteristics as well as operating conditions for various kinds of refrigerators .

Three Essentials for Checkup

1) Look

a) Check the tubing of refrigerating system for cracks and various welding points for leaks; if leakage occurs, an oil stain can be seen definitely.

b) Check the suction and exhaust pressure values (high pressure and low pressure) of compressor to see whether they are normal.

c) Check the conditions of frost attached to its evaporator and gas return tube .It is abnormal if frost has formed on part of the evaporator or there is no frost attached to it .

d) Pay attention to the speed of temperature drop inside freezer compartment .It is abnormal if the speed of temperature drop is obviously slower than the corresponding normal speed .

e) Check the environment to see whether it is suitable for placing a refrigerator .

f) Check refrigerator door seal, case, table surface and heat insulation layer .

g) Look at the main control board to ascertain if various indication states are normal.

2) Listen

a) Listen to the noises produced when the compressor is running

Hums from a fully enclosed aggregate unit is the sound caused by overload indicating that the motor cannot be started normally, meanwhile, a clattering sound can be heard from inside the start relay, which is produced because the start contacts cannot be released normally .A whistling sound is caused by the high pressure gas flowing out of the crack of the pressure tube inside the compressor, and clucks are the sound of striking after the suspended spring inside the compressor has broken.

During the normal operation of compressor ,a slight and uniform hum sound due to undulation of electric current can be heard generally ,this is a normal phenomenon .However ,if it sounds like “tong ,tong …”,i.e., an impact sound inside the compressor ,this means that a large quantity of wet vapor of refrigerant or refrigerating oil has come into the compressor cylinder; if it sounds like “dang ,dang…”, a striking sound of metal parts inside the compressor ,this means that some moving parts have loosened (note to differentiate this sound from those formed during starting or stopping the compressor).

b) Listen to the sound caused by the flowing of gas in the evaporator

Open the refrigerator door while the compressor is in operation ,incline your ear and listen attentively the gas flow sound inside the evaporator .If it sounds like gentle whistling accompanied by a sound similar to water flowing ,this is the sound produced by the normal circulation of refrigerant within the evaporator .In case only the gas flowing sound can be heard and there is no water flowing sound ,this indicates that the refrigerant has already percolated .If neither the flowing sound nor the gas sounds from the evaporator can be heard ,this means that the filter or capillary has been clogged .

3) Touch and Feel

a) Feel the compressor when running, its temperature should be generally less than 90 in the normal state (it may exceed 90 in case of running for a longer period of time).

b) After the compressor has operated normally for 5~10 minutes, touch and feel the condenser ,the temperature of its upper part should be higher than that of its lower part (or its right part is hotter than its left part ,depending on the type of condenser coil),this indicates that the refrigerant is circulating . If the condenser is not hot, this means the leakage of refrigerant .In case the condenser radiates heat for only several minutes and then cools down, this means that the filter and capillary have been clogged .As for the forced air cooling condenser, hot air will be blown out of it; this means that the system is out of order.

c) Feel the filter’s temperature .During the normal operation of refrigerating system ,the temperature on the filter’s surface should be a little higher than the ambient temperature ;if you touch it with your hand ,you will have a sense of slight heat .In case dew condensation appears due to the f Maintenance Service and Trouble Shooting ambient temperature ,this means that most meshes of its screen has been clogged ,resulting in an obstructed flowing of refrigerant ,thus causing a drop in temperature due to throttling .

d) Feel the temperature of exhaust gas from the refrigerating system .the exhaust gas should be very hot and this is the normal working state .For those refrigerator with enclosed type of compressor refrigerating system, no frost or dew drop will from on the gas suction tube, otherwise, there is something wrong in the system (Frosting and dew condensation may appear for a very short time period when just starting the machine, this is a normal phenomenon). Because a refrigerator is a combination of several components ,they are related and have influence on each other .In case an abnormal phenomenon has been found through the above-mentioned checkups ,you need not to

make a hasty conclusion based on only one abnormal phenomenon .It is advisable to find out two or more abnormal phenomenon ,or conduct troubleshooting comprehensively with the aid of instruments or other ways ,because several kinds of troubles may share a common abnormal phenomenon ,and two or more abnormal phenomena may occur simultaneously due to a certain trouble .With this method ,you can reject some suspicious troubles and finally make a correct judgment .

8-3 Analysis of Troubles and Troubleshooting

8-3-1 Poor Refrigerating Effect

The so-called “poor refrigerating effect “ refers to the fact that the refrigerator can operate and refrigerator normally ,but the temperature in the refrigerator cannot drop to the prescribed value under the stipulated working conditions .In view of there are many causes for this phenomenon ,we are going to discuss and analyze it in the following 7 aspects :

1) Leakage of refrigerant

Analysis of Trouble

The leakage of refrigerant in the system will result in an insufficient refrigerating capacity ,the resulting phenomena are its lower gas suction pressure and exhaust pressure as well as higher exhaust gas temperature .The exhaust tube feels rather hot ,and a continuous gas flowing sound louder than usual can be heard at the outlet of the capillary ,and no frost or a smaller quantity of loose frost appears on the evaporator .After shut down ,the balance pressure in the system is usually lower than the saturation pressure corresponding to the same ambient temperature .

Remedy

In case there is leakage of refrigerant from the system, do not hurry to recharge it with refrigerant, manage to find out leak points immediately, and make a note of from where it leaks ---welding points and parts .After having them repaired, recharge refrigerant.

There are so many joints and sealed surfaces in a refrigerator ,accordingly ,quite a lot potential leak points do exist in the system .In troubleshooting ,pay attention to those parts that are liable to leak ,check main connection points for oil seepage and tubing for cracks .If there is no severer leak point ,charge the system with nitrogen and detect leak points with the commonly adopted method ,repair them ,evacuate ,charge the system with refrigerant ,and then turn on the refrigerator to make a test run .

2) Too much refrigerant charged into the system

Analysis of Trouble

a) In case the amount of refrigerant charged into the system exceeds its nominal capacity ,the superfluous refrigerant will of course take some space of the evaporator ,thus reducing its heat-dissipation area and hence the refrigerating efficiency of the system .The abnormal phenomena caused by this reason are as follows :the gas suction and exhaust pressures are generally higher than their respective normal values ,the temperature of its condenser is higher and the electric

current of the compressor rises ,loose frost forms on the evaporator ,the refrigerator temperature drops slowly ,and frost appears on the gas return tube .

b) In case excessive refrigerant has been charged, the liquid refrigerant that cannot evaporates in the evaporator will return to the compressor, and thus a phenomenon of “liquid striking” will occur .The liquid refrigerant evaporates and effervesces as soon as it flows into the refrigerating oil at the bottom of compressor .If the condition is severe, foams will fill all over inside the compressor housing and be sucked by the piston, causing damage to the components of compressor.

Remedy

According to the operating procedures, it is mandatory to turn the machine off, and several minutes later, open the refrigerant charging tube and let the refrigerant escape from it, replace the dry filter, recharge refrigerant after evacuating, and then seal the charging port.

3) There is air left in the refrigerating system

Analysis of Trouble

Residual air in the refrigerating system will reduce its refrigerating efficiency .The prominent phenomena are the increase in its gas suction and exhaust pressures (however ,the gas exhaust pressure will not exceed its rated value),obvious increase in temperature in the segment from the compressor outlet to the condenser inlet .Because there is air in the system ,both the gas exhaust pressure and temperature will rise ,and moreover ,the gas flowing sound is intermittent and obviously louder .

Remedy

After shut down for several minutes, open the tubing, evacuate it and then recharge the system with refrigerant.

4) Low efficiency of compressor

Analysis of Trouble

Low efficiency of a refrigerating compressor refers to the actual reduction of gas discharge capacity ,and hence the corresponding reduction of refrigerating capacity ,under the condition that the refrigerant in the system is unchanged .This phenomenon occurs mostly when the compressor has been used for quite a long time, its moving parts have worn to a considerable degree ,fit clearance between various parts have increased and sealing property of its gas valve has deteriorated ,resulting in an decrease in its actual gas discharge capacity .

Methods of Judgment

Measure the high and low pressures with pressure gauges to see whether they are normal .If an abnormal sound comes from the compressor or the temperature of its causing is too high ,Cut the discharge port open and operate the compressor ,feel it if there is pressure at the discharge port with your finger (For a normal compressor ,its discharge port is difficult to be blocked with your finger if you just apply a little effort).

5) Too thick frost layer formed on evaporator

Analysis of Trouble

If a direct cooling refrigerator is to be used for a prolonged period of time ,be sure to defrost its evaporator regularly ;if you fail to do so ,the frost layer on the evaporator tubing will become thicker and thicker .Heat conduction will be severely affected when the whole tubing is wrapped with a transparent ice layer ,and finally the temperature in the refrigerator cannot drop down to the prescribed range .

Remedy

Turn the refrigerator off, and make preparations for defrosting, open the refrigerator door to let the air come in, or use a fan to speed up air flowing so as to shorten the time needed for defrosting .Never strike the frost layer with any iron tools or wood stick in order to avoid damage to the evaporator tubing.

6) Refrigerating oil left in evaporator tubing

Analysis of Trouble

During the process of refrigerating cycles, a little refrigerating oil may remain in the evaporator tubing, and after a longer time of operation, if there is considerable refrigerating oil left in the evaporator, the heat conduction effect will be severely affected, thus causing a poor refrigerating effect.

Remedy

It is quite difficult to determine whether this trouble is caused by the refrigerating oil left in the evaporator tubing, because this kind of

Maintenance Service and Trouble Shooting phenomenon and other several trouble are tends to be confused .Generally speaking, you can make a judgment based on the frost formed on the evaporator .If the frost does not cover the evaporator, and moreover, it is loosely formed ,you can make a judgment that the deterioration of refrigerating effect is due to the accumulation of refrigerating oil left in the evaporator tubing in case no other troubles have been found . To clear off refrigerating oil left in the evaporator, dismantle the evaporator, purge it thoroughly and then dry it .In case it is difficult to dismantle it, charge refrigerant from the evaporator inlet to wash it several times, then purge and dry it with nitrogen.

7) Flowing obstructed in refrigerating system

Analysis of Trouble

Because the refrigerating system was originally not purged thoroughly ,some of the filter screen meshes have been clogged by dirt accumulated in the filter after using it for a certain time of period ,thus resulting in a decrease in flow rate ,and hence a poorer refrigerating effect .

The abnormal phenomena caused by this kind of slight clogging in the system are as follows: the gas discharge pressure is lower, the temperature of discharged gas drops down, the position clogged has a temperature lower than that in normal conditions ,and for a severe clogging ,even dew condensation as frosting may appear .

Remedy

Purge the tubing ,and after replacing the dry filter with a new one or clearing it thoroughly ,recharge the system with refrigerant and seal the charging port .

8-3-2 No Refrigerating

The phenomenon that the compressor runs normally, but no frost (or only a little frost) appears on the evaporator, and the refrigerator temperature does not drop down is called “no refrigerating”. There are many causes for this trouble and it is relatively complicated, too. In servicing, special attention to finding direct causes for this phenomenon .Three main potential causes for this trouble are analyzed below:

1) All refrigerant in the system has leaked out

Analysis of Trouble

Leak points in the refrigerating system have not been found and repaired timely ,thus resulting in the total escape of refrigerant .There are two kinds of leakage :I) slow leakage for instance ,when we want to use a refrigerator that has been put out of quite a long time ,we find the leakage of refrigerant ,or in the course of its operation ,we have found that the refrigerator is gradually becoming not so cold and finally no refrigerating cab be achieved ; ii) fast leakage in that case ,all the refrigerant will escape swiftly due to abrupt rupture of system tubing .

Symptoms of total leakage of refrigerant are mainly as follows: the Maintenance Service and Trouble Shooting compressor can be started easily (if there is no damage to the compressor parts) and its operating current becomes low, its gas suction pressure is high and discharge pressure is lower, the gas discharge tube feels rather cold, no sound of gas eruption from the liquid in the evaporator can be heard, and no will gush out of the process tube if you cut it open after shutdown.

Remedy

Check the whole machine, particularly those locations which are liable to leak .After leak points have been found, repair them or replace them with new parts according to specific circumstances, then evacuate the system and finally charge refrigerant.

2) Refrigerating system has been clogged

a) Clogged with Ice

Analysis of Trouble

The dryness treatment for the major parts in the refrigerating system has been performed improperly, the effect of air purging for the whole system is not good ,or the water content in the refrigerant is out of standard ,all these will cause the expansion valve to be clogged with ice .The symptom for this trouble are as follows :the refrigerator sometimes can refrigerate and sometimes cannot :the refrigerator compartment works normally at the beginning ,but after working for a certain period of time ,frosting begins at the clogged position ,evaporation temperature reaches below 0 , water will accumulate at the narrow part of the capillary and clog it gradually ,then frost begins to melt at the evaporator ,no gas flowing sound can be heard ,and the gas suction pressure assumes a state of vacuum .Note that these phenomena will appear intermittently ; sometimes ,the refrigerator works well ,and sometimes not well .In order to determine whether it is clogged with ice ,heat the suspicious points with hot water to make ice melt ,and after a while if a gas flowing sound resulting from an

abrupt gush is heard and the gas suction pressure rises as well ,it can be confirmed that the trouble is caused by ice clogging .

Remedy

If there is too much moisture in the refrigerating system, it is advisable to release the refrigerant, purge the tubing with nitrogen, and then charge the system with the filtered refrigerant. However, the commonly adopted method is to connect a filter with moisture absorbers (such as silica-gel, anhydrous calcium chloride) to the refrigerating system so as to filter out the moisture from the system, then replace the filter, evacuate it again and finally charge the system with refrigerant.

b) Clogged with dirt in capillary

Analysis of Trouble

The capillary inlet is a place where coarse-grained dirt or refrigerant oil in the system will tend to settle down and clog it. In case considerable dirt accumulates there, the whole filter screen may be blocked totally, making the refrigerant unable to go through. Clogging with dirt exhibits the same symptoms as that with ice, namely, higher gas suction pressure, lower temperature of discharged gas, and no gas flowing sound from the evaporator. The difference between the both is as follows: if the clogging is caused by dirt, tapping the suspicious clogged point (generally in the capillary or the connection joint of the filter) may cause the refrigerant to flow through partially, resulting in some corresponding change, whereas in that case if you heat it with a hot towel, no reaction will happen, no flowing sound can be heard, moreover, there is no periodic change. After rejecting the possibility of ice clogging, it can be generally considered as the clogging due to dirt.

Remedy

Dismantle the system, remove the dry filter from it, purge the tubing with nitrogen, install a new filter, then evacuate it and finally charge it with refrigerant.

C) Clogging in filter

Analysis of Trouble

Total clogging of a filter is rarely to occur. This trouble is mostly caused by the paste-like matter formed from the substances filled into the system or other dust after the refrigerator has been used for a longer time, or by the dirt accumulated gradually inside the filter. Sometimes, tapping the filter nay cause a passage for flowing, Touching it with your hand, you will feel that it is cooler compared with its temperature in the normal state.

Remedy

The same as described in the capillary clogging with dirt.

3) Troubles of Compressor

a) Breakage of gas suction and discharge valve blocks

Analysis of Trouble

The compressor works by means of the opening and closing of gas suction valve and discharge valve to suck and discharge the refrigerant. If the valve block is broken, the refrigerant cannot be discharged, and hence no refrigerating can be achieved.

Method for making judgment

It is quite difficult to differentiate this trouble from others because they often have similar symptoms. In repairing, firstly, hear attentively if there is some abnormal sound coming from the compressor (sometimes , the broken pieces of valve block may strike against the cylinder), and feel the compressor casing with your hand to ascertain whether it is too hot, this is also helpful to the troubleshooting; secondly, measure the pressures at the high and low pressure ports of the compressor with pressure gauges, if the gas suction valve block is broken, the suction pressure gauge pointer will swing violently and the suction pressure is very high, whereas when the gas discharge valve block is broken , the discharge pressure gauge pointer will swing drastically and the discharge pressure is very high. In the both cases, stop the compressor at once, and if technique is available, open the cylinder cover and check up the valve block, repair it, or replace it with a new one.

8-3-3 Sudden stop

The cause of sudden stop of a compressor during its running is mostly that the gas suction pressure and/or discharge pressure exceed their respective prescribed ranges, thus making a pressure-operated protective relay shut off the power to the compressor and stop it. In the following we discuss mainly the reasons for causing excessively high gas discharge pressure and low suction pressure.

1) Stoppage due to excessively high gas discharge pressure

a) Too much refrigerant charged into the system

Analysis of Trouble

The phenomenon, such as loose frosting and poor refrigerating effect, may occur if excessive refrigerant has been charged into the system. Superfluous refrigerant will occupy a certain space of the evaporator, thus reduce its heat dissipating area, and the phenomenon of “liquid striking” may occur, too. Meanwhile, dew or frost condensation may occur on the gas return tube, and the gas discharge pressure will obviously rise, when it reaches the threshold value, the protective relay will actuate and shut off the power supply to the compressor.

Remedy

Open the tubing, re-evacuate and then charge the system with a proper quantity of refrigerant.

b) Air left in the system

Analysis of Trouble

The residual air in the system will circulate together with the refrigerant in the system. The major symptoms caused by this residual air is higher gas discharge pressure, higher discharged gas temperature (the gas discharge tubing is considerably hot when you feel it with your hand), and poorer refrigerating effect. Furthermore, the gas discharge pressure will exceed its normal value when the compressor has run for a period not too long, thus making the protective relay actuate and bring to a stoppage.

Remedy

Check up how the air has been left in the refrigerating system. Generally, there are two possibilities: one is that the air has been sucked into the system when repairing due to carelessness, or it has not been purged out totally when evacuating the system; the other is that there are leak points at the low pressure end of the refrigerating system. Leak points appear mostly in those low temperature parts or assemblies, because the evaporation temperature is lower for such low temperature devices, especially at the low pressure end, it is easier for the air goes into the system. Once it has been ascertained that air does exist in the system, you have to open the tubing, re-evaluate it and then charge it with refrigerant.

2) Stoppage due to electric troubles

a) Thermostat is out of control

Analysis of Trouble

In case the thermostat does not work in its good order or its temperature sensor has not been installed properly, frequent stoppage is also likely to occur.

Remedy

Try to adjust the temperature sensor's position until the compressor can be started and stopped normally. If this cannot be achieved, and the stoppage still occurs repeatedly, it is most likely that the mechanical parts or contacts are out of order, disassemble the thermostat, make a thorough checkup and repair it.

b) Overload of electric motor

Analysis of Trouble

Probably, too many things have been put into the refrigerator, and hence the thermal load exceeds its refrigerating capacity ; or in case the power supply voltage drops considerably, the current flowing through the motor will increase drastically making the thermal protector actuate and the fuse blown , and hence the motor stops running. If the motor is still running continuously in such a case , its windings will be burned out .

Remedy

Reduce the thermal load, pay attention to the variation in voltage of the power supply.

c) Abnormal thermal protection

Analysis of Trouble

The compressor current is within its normal range, but the thermal protector actuates repeatedly.

Remedy

Replace the thermal protector with a new one.

3) Sudden stoppage due to other causes

Normal Stoppage

Start and stop of the compressor is generally controlled by a thermostat . When the temperature in the refrigerator reaches its desired value, the thermostat will shut down the compressor automatically. Never take this normal operation as a trouble, care should be taken to differentiate it from other real troubles in servicing.

8-3-4 Compressor could not be start

In case the compressor cannot be started, you must find out the origins of this trouble through checkup step by step, because probably there are many causes, including those electrical and mechanical.

1) Inspect the power supply to see whether it is connected to the compressor circuit.

Analysis of Trouble

In case the compressor cannot be started, this will generally exhibit in the power supply circuit, for instance, power failure, poor contact of switch, and blown fuse. Make a comprehensive analysis of these phenomena, fine out its real cause and take correct measures to remove this trouble.

Remedy

a) Check the input power circuit to see whether where is voltage of the power supply, namely, the circuit which is connected to the knife switch. This can be determined with an avometer or a test pencil. If a blown fuse is found, ascertain and remove its cause, then replace it with a new one of the same specifications.

b) Check the compressor accessories, including its thermal protector and relay. In case the thermal protector is damaged, the compressor cannot be powered on. If the relay is out of order, the motor will not run and hum sound can be heard from it after the compressor is turned on, in that case, shut it down immediately, otherwise, the motor windings will be burned out in case this condition lasts longer.

c) Check the relay contacts and plugs to see if they are perfect and work reliably. Poor contact may cause the motor not running or humming.

2) Check the circuit voltage to see whether it is normal.

Analysis of trouble

If the circuit voltage is obviously lower than its rated value, it will be difficult to start the motor, and a hum sound can be heard from it.

Remedy

Measure the voltage with a voltmeter, if it is really too low, give directions to the user for buying a stabilizer so as to step up the voltage, thus normal operation can be achieved.

3) Check the thermal relay to see whether its contacts are closed.

Analysis of Trouble

The contacts of thermal relay sometimes may be open due to the leakage of temperature sensing agent from the temperature sensor.

Remedy

Remove the relay cover to check up its contacts, if they are open, this means that the original setting is not properly set or temperature sensing agent has leaked out of the temperature sensor. Try to turn the adjusting stem of this value in the direction of the lower temperature graduation, and then check the contacts to see whether they are closed. If they are still not closed, dismantle the temperature

sensing disc and then immerse it into warm water to see whether the contacts actuate, if not, it can be preliminarily determine that temperature sensing agent has leaked out, and it must be replaced with a new thermostat.

4) Motor troubles and other electric faults

a) Motor windings have been burned or short-circuited between turns

8-3-5 Compressor won't stop

Sometimes, the compressor will run continuously (for several hours or run without end), If the food placed in the refrigerator is not too much, there may be the following two situations: i) the refrigerator very low, this means that the control system is probably out of order; ii) the control system works normally, and there are troubles in the refrigerating system or other parts.

1) Temperature is set improperly

a) The temperature control knob is set to the "coldest" position. This position is to be used for fast freezing or continuous running, its temperature for power off is too low, therefore, the compressor won't stop and the temperature in the refrigerator becomes lower and lower .

b) Inspection method: check the temperature control knob to see whether it is set in the position "coldest".

2) Thermostat is malfunctioning and makes the compressor running continuously

Analysis of Trouble

When the thermostat doesn't work normally, it will make the compressor run continuously, and hence very low temperature will be achieved in the refrigerator. The fault is generally due to the fact that the contacts of the thermostat cannot be released.

Remedy

Dismantle the thermostat and make a through checkup, if it is totally out of functioning, replace it with a new one.

3) Evaporation temperature is too high in refrigerating system, resulting in lower refrigerating capacity and hence continuous running of compressor

Analysis of Trouble

Leakage of refrigerant and clogging in a refrigerating system will directly affect its refrigerating capacity. Due to the reduction in its refrigerating capacity, the refrigerator temperature cannot reach its rated value, the thermostat won't work, thus the compressor runs continuously. When the evaporation temperature in the system is too high, the temperature sensing agent in the temperature sensor is also hotter, therefore, the thermostat is unable to cut off the power supply to the compressor and stop it.

Remedy

If it has been found that the refrigerant in the system is insufficient in quantity, recharge it with refrigerant. In case clogging occurs, disassemble the part where it is blocked. If the evaporation temperature is too high, settle this problem with an appropriate quantity of refrigerant.

4) No stoppage of compressor due to damaged heat-insulation layer inside case body and/or door seal

Analysis of Trouble

When the heat-insulation layer inside the case body deteriorates or the door seal is not closely touches the door frame, the temperature in the refrigerator will rise and makes the compressor running continuously.

Remedy

Check the heat-insulation layer for its damaged parts; repair it to improve its heat-insulation property. If the door has deformed or the door seal is not tightly sealed against the case body, repair them, respectively.

5) Too much food is placed in the refrigerator, or is placed too densely, resulting in poor ventilation or poor conditions for temperature sensing, and hence no stoppage of the compressor.

6) Too high ambient temperature, poorer ventilation and heat dissipation make the compressor running without stop.

8-3-6. Electric leakage of refrigerator

1) Slight electric leakage

Electric insulation has deteriorated due to being affected with damp, thus resulting in slight electric leakage.

2) Serious electric leakage

Refrigerator case has become live due to faults occurred in some electric devices or the erroneous wiring in installing power cord plug or outlet by the user. This is very dangerous.

3) Electric leakage test

a) Slight electric leakage

A tingle sense will be experienced as soon as you touch the metal parts of the refrigerator with your hand .When you test them with a test pencil, its neon lamp will come on .In that case, the first thing you need to do is to determine whether the grounding is perfect .If the grounding is no problem, turn off the refrigerator immediately, then check the insulation of electric circuits with an avometer.

b) Serious electric leakage

Never touch the case body of the refrigerator ,its door handle or other metal parts with your hand .Test the refrigerator with a test pencil ,it will light up intensively ;measure the resistance between the power cord plug and the case body with an avometer ,the reading will be zero (0); in the worst case ,the fuse will be blown .Check the 3-prong outlet to see whether the live wire and the null line are inversely connected ,this makes the ground protection lead-out from the power cord plug being connected to the live wire .Another possibility is that the live wire and null line of the outdoor power supply circuit have been inversely connected accordingly ,this makes the null line become a live wire .

8-3-7.Stronger vibration and loader noise

1) Refrigerator placed improperly

a) Uneven ground

Uneven ground will cause the refrigerator to be placed unsteadily ,causing stronger vibration and noise during its operation .

b) Leveling screws not properly adjusted

If the leveling screws on refrigerator legs have not been adjusted properly, vibration and noise will still occur even if the refrigerator has been placed on a level ground.

2) Abnormal noise from compressor

Three suspended spring inside the compressor case are out of balance, and strike against the case, moreover, the wear of compressor parts may cause noise sometimes.

3) Resonance of tubing and loosening of parts

Improper and compact laying of tubes or the loosening of parts may cause vibration and noise .

4) Inspection method

To find the sources of noise ,press the vibration spot with your hand while the refrigerator is in operation and listen attentively whether the vibration becomes weaker or vanishes .If the refrigerator has not been levelly placed ,put a level meter on its top table and adjust the leveling screws on its legs .In case noise occurs from the compressor ,strike different locations on the side surface of its case using a rubber hammer or hand hammer with a wood block in-between so as to determine whether the suspended springs are out of balance or being seized .

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